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[72] Inventors **Akira Akima**
Tokyo;
Kazuyoshi Yoshida; Shigeo Ujihara,
Saitama-ken, Japan

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[73] Assignee **Honda Giken Kogyo Kabushiki Kaisha**
Chuo-ku, Tokyo, Japan

[54] **APPARATUS FOR CONTROLLING THE OPERATION OF A SHIFT MEMBER AND INPUT CLUTCH IN A GEAR TYPE TRANSMISSION**
2 Claims, 4 Drawing Figs.

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192/4, 192/85
[51] **Int. Cl.** **F16d 67/00**
[50] **Field of Search** ..... 192/3.5(FP), 3.5(FPE), 3.5(FR)

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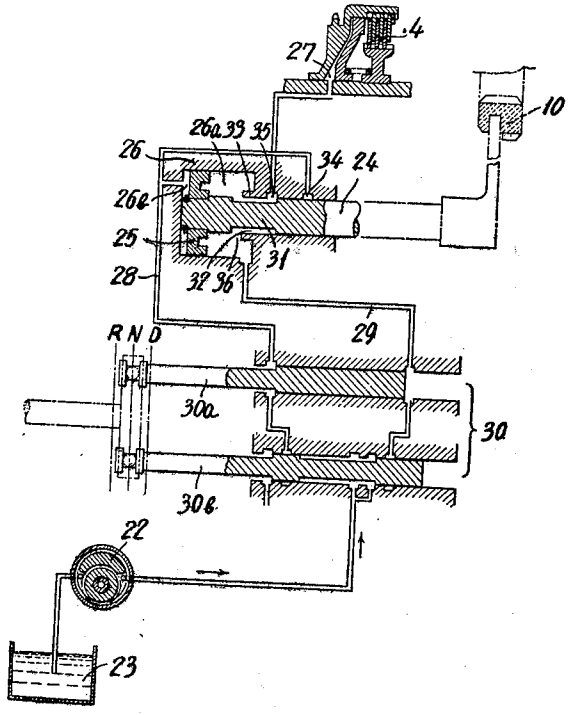
Primary Examiner—Benjamin W. Wyche III
Attorney—Waters, Roditi, Schwartz & Nissen

ABSTRACT: An operating cylinder for a shift member is supplied with pressure fluid from a source thereof by the manual operation of a valve, the shift member being connected to a piston in the cylinder and being displaced by the pressure fluid thereby to displace the shift member to an operative position. A rod connects the piston and shift member and is provided with a groove which serves to deliver pressure fluid to a passage leading to an operating cylinder of a clutch only when the piston approaches the end of its stroke and the shift member has been brought to operative position.



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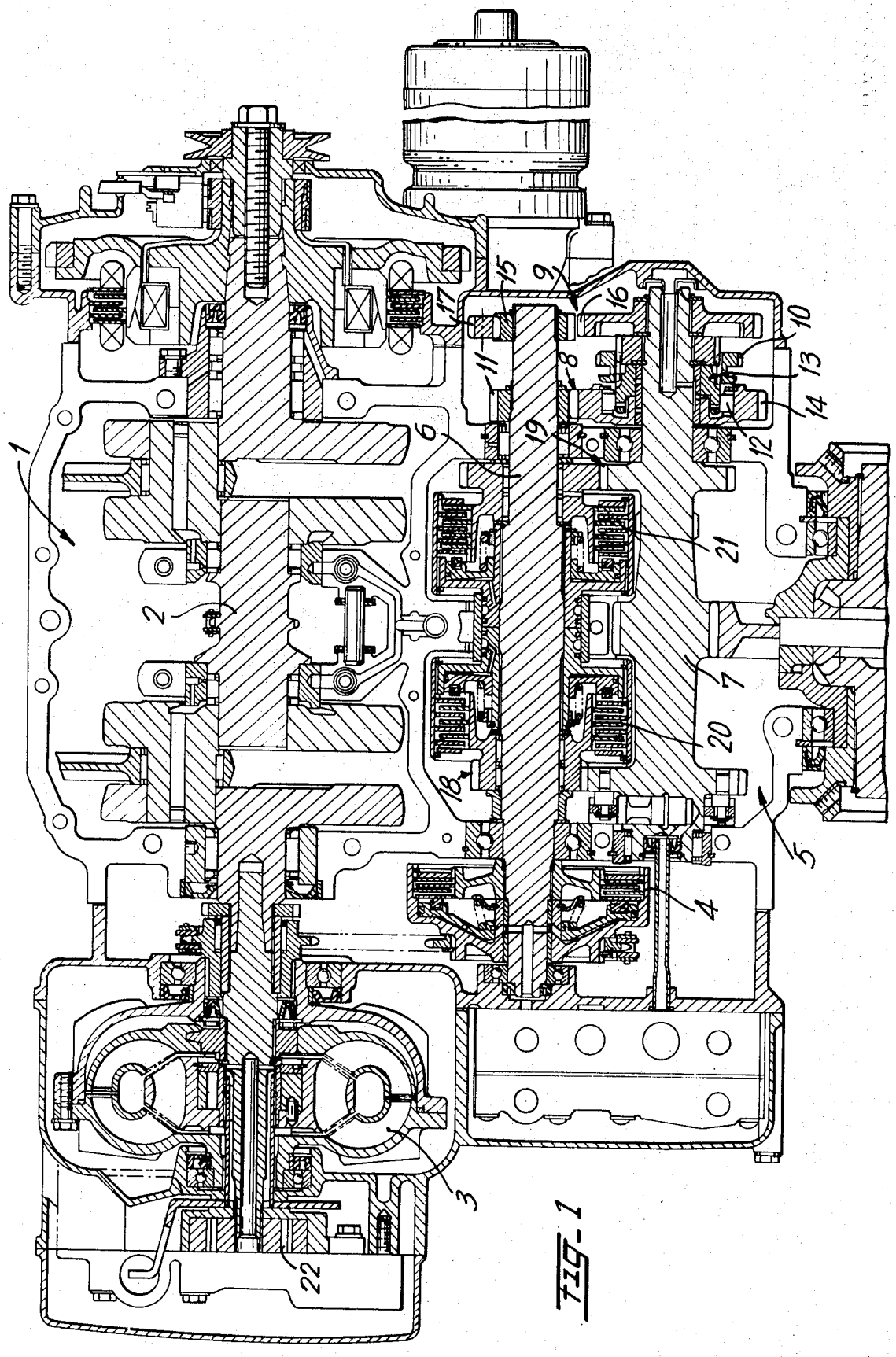
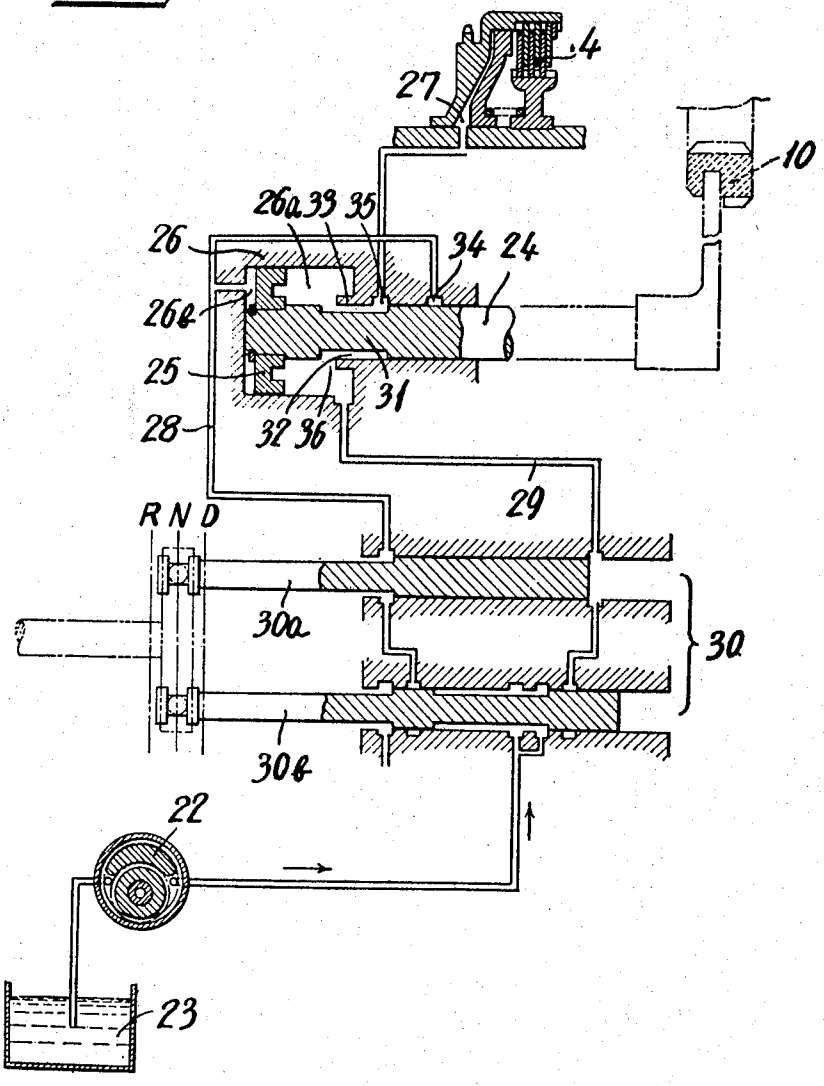


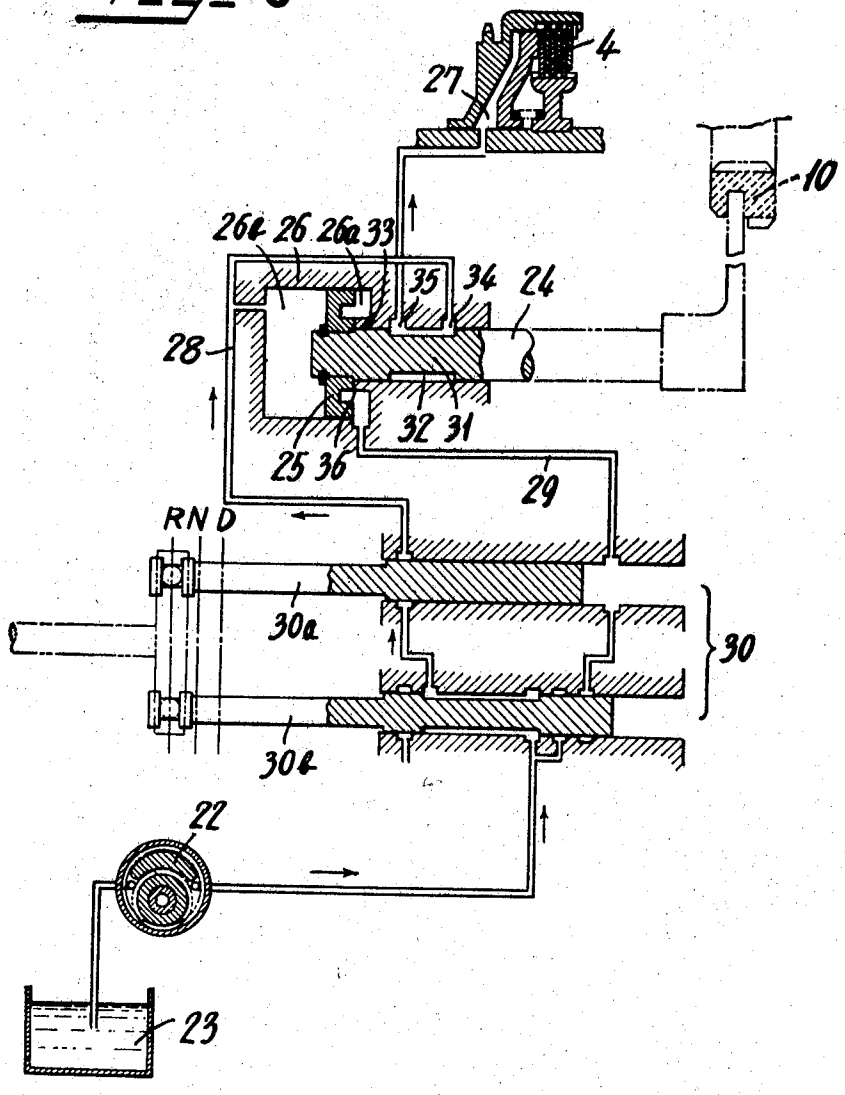
FIG. 1

Fig. 2



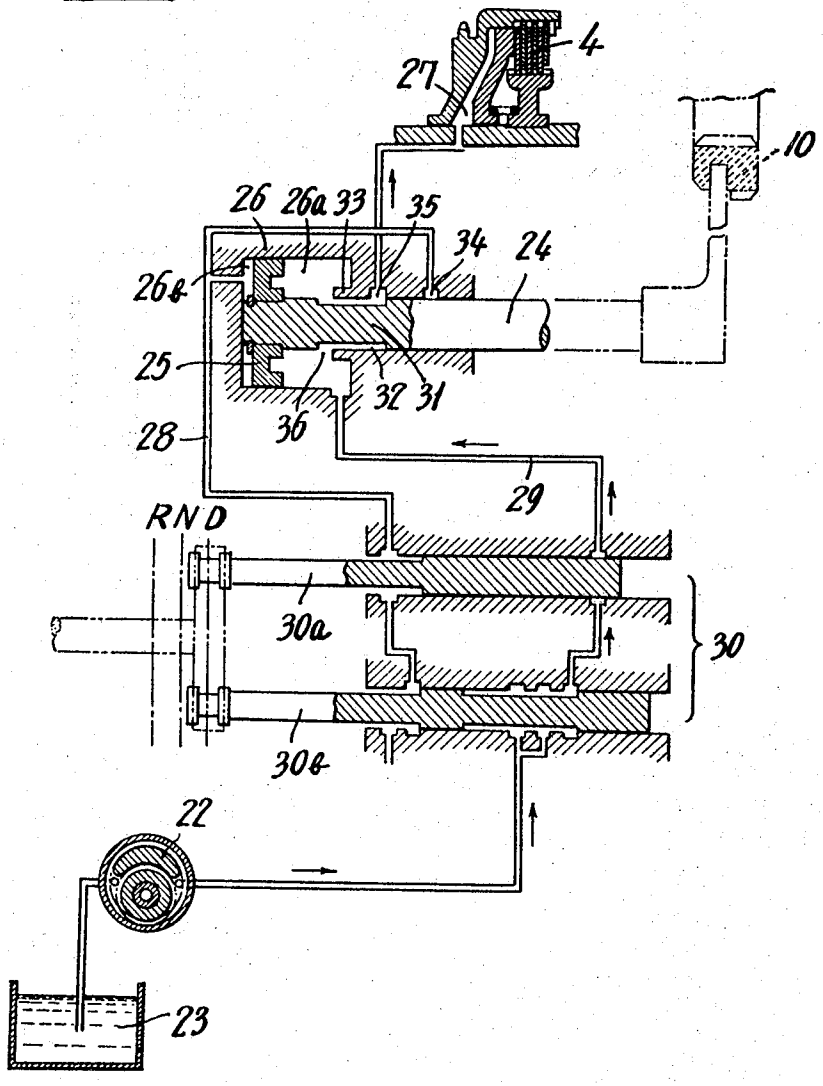
INVENTOR
Akira Akima
BY Kazuyoshi Yoshida
Shigeo Ujihara

FIG. 3



INVENTOR
Akira Akima
BY Kazuyoshi Yoshida
Shigeo Ujihara

Fig. 4



INVENTOR
Akira Akima
BY Kazuyoshi Yoshida
Shigeo Ujihara

APPARATUS FOR CONTROLLING THE OPERATION OF A SHIFT MEMBER AND INPUT CLUTCH IN A GEAR TYPE TRANSMISSION

BRIEF SUMMARY OF THE INVENTION

This invention relates to an apparatus which utilizes a pressure fluid to operate both a shift member such as a shift gear, or the like, in a gear-type transmission and an input clutch for connecting said transmission with a driving source such as an internal combustion engine or the like.

It is required in this kind of apparatus that a pressure fluid be applied first to the shift member for operating the same and then applied to the clutch for operating the same. If the clutch is first operated by mistake by being supplied with the pressure fluid, not only does it become difficult for the shift member to shift but also the shift member and the cooperating members are liable to be damaged.

An object of this invention is to provide an apparatus whereby such successive supply of pressure fluid can be effected automatically and positively, and the invention is characterized in that an operation cylinder for a shift member and an operation cylinder for an input clutch are in communication with a pressure fluid source through a first passage and a second passage respectively, and a manually operable valve is interposed in the first passage to control supply of pressure fluid to the operation cylinder of the shift member, a valve being provided in the second passage to automatically open near the end of the shift movement of the shift member.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional plan view of a gear-type transmission provided with the apparatus of this invention,

FIG. 2 is a diagram showing a fluid circuit of one example of the apparatus, and

FIGS. 3 and 4 are diagrams of the circuit in different respective operating conditions.

DETAILED DESCRIPTION

Referring to the drawing, numeral **1** denotes an internal combustion engine, and a crank shaft **2** of the engine is connected through a torque converter **3** and an input clutch **4** to a gear transmission apparatus **5**. The gear transmission apparatus **5** comprises an input shaft **6**, and an output shaft **7** parallel thereto. A first transmission system **8** for forward movement and a second transmission system **9** for reverse movement are interposed in parallel between the two shafts **6** and **7**, so that when a shift member **10** is moved to the left and the right, respectively, in the drawing the transmission systems **8** and **9** are selectively operated. The first transmission system **8** comprises a gear **11** fixedly mounted on the input shaft **6** and a one-way clutch **12** loosely mounted on the output shaft **7**, and the clutch **12** comprises an inner member **13**, and an outer gear member **14** in mesh with said gear **11**. The second transmission system **9** comprises a gear **15** fixedly mounted on the input shaft **6**, a gear **16** loosely mounted on the output shaft **7** and an intermediate gear **17** in mesh with the two gears **15** and **16**. The shift member **10** is of the shift clutch type in splined engagement with the output shaft **7** and if member **10** is moved respectively to the left and the right, the member **10** is selectively brought in engagement with the inner member **13** and the gear **16** for selectively operating the respective transmission systems **8** and **9**. There are additionally provided between the two shafts **6** and **7** a third transmission system **18** for low speed and a fourth transmission system **19** for high speed. The systems **18** and **19** are in parallel so that they may be selectively operated in accordance with the operation of their corresponding frictional clutches **20** and **21**, but this portion has no relation to the present invention and detailed explanation thereof is therefore omitted.

According to this invention, it is intended that both the input clutch **4** and the shift member **10** be operated by a pressure fluid, and for this purpose an oil pressure pump **22** driven by the engine **1** serves as a pressure fluid source, the pump **22** being connected on its suction side to a reservoir **23**.

A piston rod **24** has the shift member **10** connected to one end thereof and a piston **25** connected to the other end, the piston being slidably mounted in a cylinder **26** which constitutes an operation cylinder for the shift member **10**. The input clutch **4** is provided with an oil pressure operating cylinder **27** in a well-known manner.

The body containing the cylinder **26** is provided with passages **28** and **29** which are in communication with respective chambers **26*b*** and **26*a*** of the cylinder **26** formed on opposite sides of the piston **25**, so that when a manually operable valve **30** is moved from the neutral position N in FIG. **2** to a reverse position R as shown in FIG. **3**, the passage **28** is placed into communication, through valve **30**, with the oil pressure pump **22** and the passage **29** is placed into communication, through valve **30**, with the reservoir **23**, whereas when the valve **30** is moved to a forward position D as shown in FIG. **4**, the connection of the two passages **29** and **28** are reversed. Thus, if the valve **30** is moved to the left in the drawing (R position), the oil passage **28** becomes the high-pressure side, so that the piston **25** is moved to the right to cause the piston rod **24** and the shift member **10** to move to the right to engage the first transmission system **9** at the right side in FIG. **1**, whereas if the valve **30** is moved to the right in the drawing (D position), the passage **29** becomes the high-pressure side, so that the piston **25** is moved to the left to cause the piston rod **24** and the shift member **10** to move to the left to engage the second transmission system **8** on the left side in FIG. **1**.

A valve which automatically opens near each end of the left and right movements of the shift member **10** to then feed cylinder **27** of clutch **4** is constituted as follows:

The piston rod **24** moving with the shift member **10** is formed at its center with a valve portion **31** having at its periphery an annular groove **32**, and the valve portion **31** is positioned slidably within a peripheral valve chamber **33**. The valve chamber **33** is provided with a right-hand valve opening **34** in communication with the passage **28**, an intermediate valve opening **35** in communication with the operation cylinder **27** for the input clutch **4**, and a left-hand valve opening **36** in communication through the chamber **26*a*** with the passage **29**. The openings **34**, **35**, **36** are equally spaced along the length of chamber **33** and the groove **32** has a length slightly greater than the spacing between respective openings. As described before, the piston **25**, the piston rod **24** and the shift member **10** are moved to the right in the drawing if the valve **30** is moved to the left as shown in FIG. **3**, however, when rod **24** approaches its end of movement, the groove **32** provides communication between the valve openings **34** and **35**, whereby the operation cylinder **27** is placed into communication with the passage **28** of the high-pressure side for commencing operating of the clutch **4**. As also described before, if the valve **30** is moved to the right as shown in FIG. **4**, the passage **29** becomes the high-pressure side, whereby the piston **25**, the piston rod **24** and the shift member **10** are moved to the left, and as the rod **24** approaches the end of its movement, the groove **32** provides communication between the valve openings **35** and **36**, whereby the operation cylinder **27** is placed into communication with the high-pressure side for commencing operation of clutch **4**.

In the illustrated embodiment, the manually operable valve **30** is composed of two valve rods **30*a*** and **30*b***, but the valve **30** can be modified to be formed of a single valve rod.

Thus, according to this invention, with only a single operation of the manually operable valve, it is automatically achieved that the pressure fluid is first supplied to the shift member for operating the same and then near the end of displacement of such shift member, the input clutch is supplied with the pressure fluid for being operated. Thus a situation can never occur in which the pressure fluid is first supplied to the clutch for operating the same by mistake and thereby the transmission operation is positively safeguarded against accident and potential damage.

We claim:

1. Apparatus for the operational control of a shift member and an input clutch in a gear-type transmission, said apparatus

comprising an operation cylinder for the shift member and an operation cylinder for the input clutch, a pressure fluid source, means providing a first passage and a second passage leading respectively to the operation cylinder for the shift member and the operation cylinder for the input clutch, manually operable valve means interposed in the first passage for selectively providing communication between the pressure fluid source and the operation cylinder of the shift member, the shift member being displaced by the pressure fluid from said source when the manually operable valve means is in active position and the source is in communication with the operation cylinder of the shift member, second valve means in said second passage for controlling flow of pressure fluid to said operation cylinder for said input clutch, the second valve means being operatively associated with said shift member to be automatically opened near the end of the displacement of the shift member whereby the input clutch will be operated subsequent to the shift member, a slidable piston in said operation cylinder for the shift member, a rod connecting said piston and shift member, said piston being subjected to said pressure fluid, with the manually operable valve means in active position, to be displaced thereby and thus cause displacement of the shift member, said second valve means being constituted by a portion of said rod having a peripheral groove providing communication to said second passage for the pressure fluid as the rod is displaced and the shift member approaches the end of its displacement, means providing a third passage leading to the operation cylinder for the shift member, the first and third passages opening into the operation cylinder for the shift member on opposite sides of said piston, said manually operable valve means being constructed to selectively connect the first and third passages to said source whereby the piston is double acting and the shift member can be displaced in opposite directions to two operative positions, and a valve chamber separate from said operation cylinders slidably accommodating said portion of the rod with the peripheral groove, said valve chamber having a first opening leading to one of said first and third passages, a second opening leading to said second passage, and a third opening leading to the other of said first and third passages, said openings being equally spaced apart in the direction of displacement of the rod, said groove being of a length slightly exceeding said spacing whereby the second passage is alternately placed into communication with the first and third passage when the rod approaches its end of stroke positions corresponding to the operative positions of the shift member.

2. Apparatus as claimed in claim 1 wherein one of said first and third openings opens directly into said operating cylinder for the shift member.